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IV. *Experiments on Dying Black, by Mr. James Clegg, of Redivales, near Bury. In a Letter to Dr. Percival.*

DEAR SIR,

Redde, Nov. 11, 1773. **L** I M E having been proved to increase the solvent power of water, upon astringent vegetables, for medical purposes, I was desirous of knowing if it would be equally useful in the art of dying black; to this end I made the following experiments.

EXPERIMENT I.

Four penny-weights of each of the following astringents; videlicet, Galls, Sumach, Oak Bark, Bistort Root, and Logwood, were boiled during ten minutes, in half a pint of pure river water; upon mixing the decoctions with a saturated solution of martial vitriol, in the proportion of  $\frac{1}{7}$  of the solution to  $\frac{2}{7}$  of the decoction, they struck colours differently inclining to blackness, in the following order; videlicet, Oak Bark, Bistort Root, Sumach, Galls. I then boiled the same weight of all the astringents, in the same quantity of lime water; and upon mixing them

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as above, the colours they produced were inferior to those with plain water, the astringency of the logwood, or whatever gives it the property of striking black with green vitriol, was entirely destroyed; it produced not the least blackness with any quantity of vitriol.

#### EXPERIMENT II.

Four penny-weights, of each of the astringents above-mentioned, were triturated in plain water, and four others in lime-water; the measures of water used were equal to those left, after boiling, in the last experiment; and, upon being mixed with martial vitriol as in the last experiment, the colours produced, by this means, were superior to those produced by boiling. Those triturated in lime-water were judged to be the deepest, which agrees with Mr. HENRY's experiments; but we must again except the Logwood, which gave no colour by trituration, more than by boiling in lime-water.

#### EXPERIMENT III.

All the above mixtures, having been written with as inks, and exposed six months to the air; those boiled in lime-water had faded much; those triturated in lime-water, and in plain water, had faded a little; those boiled in plain water evidently preserved their colour best.

Upon slightly rubbing the faded writings, with a fresh astringent liquor, they recovered their original

ginal blackness ; by which it appears, that it was the astringent parts of those Inks which had failed.

Does it not appear, by these experiments, that, though lime-water tends to deepen the colour produced by some astringents and martial vitriol, it by no means adds to the duration of those colours ; and as lime-water, either by trituration or coction, entirely destroys the property, in logwood, of striking black with martial vitriol, it can by no means be of service, in the black dye, where logwood is a material ingredient.

Does it not also appear, that a slight boiling is preferable to trituration, for the purposes of dying, when a durable colour is wanted ?

Having observed a solution of iron, in a *vegetable* acid, struck a deeper black, upon mixture with an astringent, and produced its effect much more expeditiously, than a strong solution of martial vitriol ; it occurred to me, that the iron, being more slightly combined with the vegetable acid, than with the vitriolic, made it more easy, for the astringent matter to decompose the former, and produce an ink ; if this was the case, I suspected, that lime-water deepened the colour of astringent and chalybeate mixtures, not so much by its action upon the astringent, as upon the chalybeate, the lime uniting with the superabundant acid, and leaving the iron, with so much of the acid, as is necessary for the formation of an ink, to be more easily attached by the astringent matter of the vegetable.

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But if this theory was well founded, it followed, from analogy, that any substance, which had a greater affinity with the vitriolic acid than iron had, would produce the same effect, in some degree, as lime. To determine this :

#### EXPERIMENT IV.

I took two vessels, containing equal measures of a strong astringent liquor, composed of galls and logwood ; into one vessel I put a small quantity of pearl ashes ; the other remained as a standard. Pieces of linen and cotton cloth, after maceration in these liquors, were thrown together into a strong solution of copperas ; they were soon after taken out, and washed in cold water ; when dry, the pieces prepared in ashes were, all of them, much deeper than the others.

I made use of different kinds of pearl and pot-ashes, as well as of many kinds of astringents ; the ashes had the same effect, whatever astringent was made use of, and the strongest alkali always produced the deepest colour ; and though ashes, used with an astringent, always gave a deeper black, than the same astringent without ashes, yet logwood, which without ashes gave not so deep a colour as galls with them, gave a much deeper black than galls with the same addition.

There was a remarkable difference, in this case, betwixt lime and ashes, in their effect upon logwood ; with lime it gave no blackness, but with ashes it produced a deeper black, than any other astringent I made use of.

Being desirous of trying the duration of colours, produced by astringents, in which different quantities of pearl ashes had been dissolved;

EXPERIMENT V.

In two pints of river water, I boiled one ounce of logwood, during ten minutes; I then added half an ounce of Aleppo galls, and boiled them together ten minutes longer; the liquor having stood to cool, was decanted off, and divided into six equal quantities. N°. 1 remained as a standard, into N°. 2 I put six grains of fine pearl ashes, N°. 3 twelve grains, N°. 4 eighteen grains, N°. 5 twenty-four grains, N°. 6 thirty grains; to six drops of each of these liquors, I added two drops of a saturated solution of copperas; N°. 2 and 3 struck a deep black, N°. 1 and 4 black, but inferior to 2 and 3, N°. 5 a brown black, N°. 6 brown.

From this experiment it appears, that N°. 5 and 6 were spoiled by an over proportion of ashes. Before I had the pleasure of seeing your experiments, wherein you demonstrate, that a quantity of acid enters into the composition of ink, I imagined the alkali decomposed the copperas too suddenly, and disengaged the iron faster, than the astringent matter could unite with it.

But, most probably, the alkali neutralized too great a portion of the acid.

All these writings having been now exposed six months to the air, in N°. 5 and 6 the blackness is quite

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quite destroyed, N°. 4 is something faded, N°. 1, 2, 3, remain nearly as they were, N°. 2 and 3 being still superior to the standard.

I am,

Your most obliged,

humble servant,

Bedivales, May 18,  
1773.

JAMES CLEGG.

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